

**Amendments to the Claims**

1. (Presently Amended) A method for calculating an approximate cost of multi-protocol label switching (MPLS)-based virtual private network (VPN) services in a network comprising a connection between a first network node and a second network node, said method comprising:

computing a greatest lower bound for ~~the~~ a bandwidth used across said connection in said ~~an~~ MPLS-based VPN;

computing a least upper bound for the bandwidth used across said connection in ~~an~~ said MPLS-based VPN; and

combining ~~the~~ said upper bound and ~~the~~ said lower bound to produce an estimate for the cost of the bandwidth used across said connection.

2. (Original) The method of claim 1, wherein the step of computing a least upper bound includes a cut constraint.

3. (Presently Amended) A ~~computer program~~ method of operating a computer system for calculating an approximate cost of multi-protocol label switching (MPLS)-based virtual private network (VPN) services, said network comprising a connection between a first network node and a second network node, said method comprising:

computing a greatest lower bound for a bandwidth used across said connection in said MPLS-based VPN;

computing a least upper bound for the bandwidth used across said connection in said MPLS-based VPN; and

combining said upper bound and said lower bound to produce an estimate for the cost of the bandwidth used across said network connection,

wherein the price charged for services provided across said VPN are determined as a function of said cost.

~~computing a greatest lower bound for the bandwidth used in an MPLS-based VPN;~~

~~—computing a least upper bound for the bandwidth used in an MPLS-based VPN;~~  
and  
~~—combining the upper bound and the lower bound to produce an estimate for the cost of the bandwidth.~~

4. (Original) The computer program method of claim 3, wherein the step of computing a least upper bound includes a cut constraint.

5. (Presently Amended) A method for calculating an approximate cost of multi-protocol label switching (MPLS) based virtual private network (VPN) services, comprising:

computing a greatest lower bound for a bandwidth used across a first network connection between a first network node and a second network node in an MPLS-based VPN~~computing a greatest lower bound for the bandwidth used in an MPLS-based VPN,~~  
comprising the steps of:

- (a) Creating an auxiliary graph of Start and Finish nodes and one node for each node in the VPN that is saturated with inbound flow;
- (b) Creating a directed edge between the nodes representing a least cost of adding flow from a node which has flow left to place to a node which has capacity to receive the flow;
- (c) Calculating a shortest path algorithm to find the path from Start and Finish nodes giving an optimal way of serving the previously unserved unit of flow.
- (d) Outputting L as a greatest lower bound for the bandwidth used;

computing a least upper bound for the bandwidth used across said network connection between said first network node and said second network node in said MPLS-based VPN~~computing a least upper bound for the bandwidth used in an MPLS-based VPN,~~  
comprising the steps of:

- (e) Creating an auxiliary graph consisting of the nodes Start, Finish, and one node for each node in the VPN that is saturated with inbound flow;
- (f) Creating a directed edge between the nodes representing a greatest cost of adding flow from a node which has flow left to place to a node which has capacity to receive the flow;
- (g) Calculating a longest path algorithm to find the path from Start to Finish, giving a worst way of serving the previously unserved unit of flow;
- (h) Outputting U as a least upper bound for the bandwidth used;

combining the upper bound and the lower bound to produce an estimate for the cost of the bandwidth used across said network connection, comprising the step of:

- (i) setting a Total cost  $\approx \alpha \times U + (1 - \alpha) \times L$

where  $\alpha$  is a measure of risk of losing money by carrying a given customer's VPN.

6. (New) A network computer for calculating an approximate cost of multi-protocol label switching (MPLS)-based virtual private network (VPN) services across a connection between a first network node and a second network node, said network comprising:

means for computing a greatest lower bound for a bandwidth used across said connection in said MPLS-based VPN;

means for computing a least upper bound for the bandwidth used across said connection in said MPLS-based VPN; and

means for combining said upper bound and said lower bound to produce an estimate for the cost of the bandwidth used across said connection.